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INTERNATIONAL AIRPORT
LOS ANGELES 45, CALIFORNIA

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Date: 7-3-61

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NONMETALLIC MATERIALS LABORATORY

MEMO

Title: "Screening Tests of Candidate High Emissivity XB-70 Engine Shroud Coatings".

1. INTRODUCTION

1.1 To protect the B-70 fuselage structure against damage from engine heat, shrouds of Rene' 41 metal will be employed. Although an emissivity value of .85 is desired for the exterior surfaces of these shrouds an emissivity of .80 would be acceptable. To attain these values the exterior surfaces of the shrouds must be coated with a highly emitting finish. It was necessary to conduct screening tests of candidate coatings to reduce the number of materials to be subjected to the lengthy processes required for complete evaluation.

2. PURPOSE

2.1 To determine the total emissivity at 1100 F of eight candidate B-70 engine shroud coating materials. The emissivity to be measured before and after heating the applied finishes for 100 hours at 1100 F.

2.2 To determine the effects of heat aging for 100 hours at 1100 F on the candidate materials.

3. CONCLUSIONS

3.1 Only one coating (A) Products Techniques Co. PT404, exhibited sufficiently high emissivities before and after heating to meet target requirements. This material had an emissivity at 1100 F of .80 and emissivity of .79 after being heated for 100 hours at 1100 F. Coatings C and D had an emissivity at 1100 F of .80 and .82 respectively but after being exposed to 1100 F for 100 hours the emissivities dropped to .64 and .58.

3.2 The coated strip heater method was employed in measuring these emissivities. The accuracy of this equipment is considered to be $\pm 10\%$. In view of this fact coatings B and E could possibly be considered for additional evaluation.

4. PROCEDURE AND RESULTS

4.1 Coating Materials:

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4.1.1 The following listed materials were tested during this investigation. The letter preceding each coating will be employed for material identification in the body of this report and in the table of test results.

<u>Code</u>	<u>Material</u>	<u>Cure</u>	<u>Source</u>
A	Coating PT-404	1 hour 325 F	Products Techniques Co.
B	High Heat Silicone Finish 517-B-3	1 hour 485 F	W. P. Fuller Co.
C	High Emissivity-High Heat Black J29978 IV	1/2 hour 450 F	Rinshed-Mason Co.
D	High Emissivity-High Heat Black J29978 V	1/2 hour 450 F	Rinshed-Mason Co.
E	NAA Coating 1012-222-1	1 hour 485 F	NAA
F	Coating 348-796	1/2 hour 400 F	E.I. DuPont Co.
G	NAA Coating 1012-222-2	1 hour 485 F	NAA
H	High Emissivity-High Heat Black J55811	1/2 hour from 450 to 1450 F	Rinshed-Mason Co.

4.2 Test Specimen Preparation:

4.2.1 Test specimens consisted of 0.5 x 18 x .040 inch strips of heat treated (in argon) Rene' 41. The materials listed in paragraph 4.1.1 were applied to these strips by spraying and air dried for a minimum of one hour followed by curing in a circulating air oven for the times and temperatures given in the preceding paragraph.

4.3 Heat Aging Test:

4.3.1 A prepared test specimen of each candidate coating was placed in an air circulating oven maintained at 1100 \pm 25 F for a period of 100 hours. At the conclusion of the heating period the specimens were examined for film defects or changes.

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4.4 Heat Aging Test Results:

4.4.1 The colors of coatings B, F, H were relatively unchanged by the exposure to 1100 F but the remaining candidate finishes were changed in varying degrees (see Table I). Coatings E, F, G were seriously affected by the heat exposure and exhibited loss of adhesion, flaking or powdering of their films. Due to poor resistance to 1100 F the coatings E, F and G were not subjected to further testing.


4.5 Total Emissivity Tests:

4.5.1 The test specimens that had successfully passed the heat aging and specimens of the same materials that had not been subjected to 100 hours exposure at 1100 F were measured for their total emissivity at 1100 F.

4.6 Total Emissivity Test Results:

4.6.1 Coating A exhibited the highest emissivity (.79) at 1100 F of the heat aged specimens. Coating D exhibited the highest emissivity (.82) of those not subjected to 100 hours at 1100 F. Detailed test results may be found in Table I.

Note: The data on which this report is based may be found on page 44 of Nonmetallic Materials Data Book No. 2674 and on page 22 of Data Book No. 1012.

Written by: 
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TABLE I

SCREENING TEST RESULTS OF COATINGS ON RENE' 41

Coating	Coating Thickness Mils	Coating Color	Coating Color After 100 Hrs. 1100 F	Coating Condition After 100 Hrs. 1100 F	Total Emissivity at 1100 F	Total Emiss. at 1100 F After 100 Hrs at 1100 F
A	1.6	Black	Md. Grey	Good	.80	.79
B	1.4	Black	Black	Good	.73	.72
C	1.6	Black	Lt. Grey	Good	.80	.64
D	1.6	Black	Lt. Grey	Good	.82	.58
E	0.5	Black	Off White	Film Flaking No Adhesion	--	--
F	1.8	Green	Green	Film Flaking No Adhesion	--	--
G	0.5	Black	Brown	Film Powdery No Adhesion	--	--
H	2.1	Black	Black	Good Some Grey Spots	.67	.77

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